AMINE PURIFICATION FOR IMPROVED EFFICIENCIES IN CO_2 SEQUESTRATION

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While technologies and applications are being piloted and tested worldwide in the areas of biofuels and alternative energy, the demand for energy continues. Industrial and political leaders are acknowledging the fact that approximately 85%[1] of the world's commercial and industrial energy needs are supplied by fossil fuels, and that a dramatic shift to non-fossil energy, if viable, could result in a disruption in energy supply. Carbon Dioxide (CO_2) sequestration and reuse addresses both green house gas emissions while allowing industry to move forward to meet demands. Using both a well-known amine technology for CO_2 capture, and a proven amine purification system, will allow for swift progression of CO_2 sequestration and reuse.

ADVANTAGES OF AMINE TECHNOLOGY

Amines have been used in numerous applications, and in most recent years, have begun to address the need for reductions in green house gas emissions. Monoethanolamine (MEA) is considered the favored solvent for CO_2 sequestration due to its preference for CO_2 over other green house gases such as hydrogen sulfide (H_2S). Moving quickly for the reduction in green house gas emissions, the power industry is adopting the technology for large CO_2 sequestration processes. Amine technology offers a significant advantage over other technologies (such as membrane or cryogenics) in that it can be incorporated into the design of new power station or retrofitted into existing stations with little design modification required.

AMINE TECHNOLOGY FOR CO_2 SEQUESTRATION

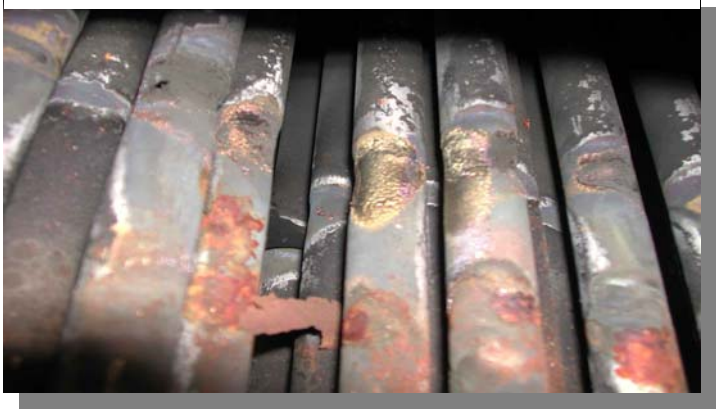
Carbon Dioxide (CO_2) sequestration, or capture and storage applications offer opportunities to reduce green house emissions from coal and other fossil fuel energy used in industrial applications. The most widely used and accepted method of CO_2 capture is through post combustion use of amine solvents. For over 60 years, amine "scrubbing" has been instrumental in oil and gas processing applications. For CO_2 sequestration, the underlying difference in the process is the large-scale production required for the removal of CO_2 from flue gas.

CHALLENGES WITH AMINE TECHNOLOGY

Amines used for CO_2 capture can present challenges for the operation such as increasing solvent efficiency, increasing regeneration efficiency, and reducing solvent degradation. Each of these challenges can be addressed by implementing an amine purification system into the design. An amine purification system must be able to continuously remove amine impurities to avoid the many problems associated with solvent and overall process efficiency.

Impurities in the amine circuit can cause excessive corrosion and amine loss through degradation. The most significant impurity within the amine solvent is the build up of heat stable salts (HSS). Heat stable salts are corrosive to metal surfaces. In gas processing applications, the amine circuits used for H_2S removal have some protection due to a protective layer of ferrous sulfide (FeS) that forms on metal surfaces. Amine circuits used for CO_2 removal do not have such benefit and are more prone to corrosion. The prime HSS component present in CO_2 applications is a formate created by the oxidation and cleavage of amine in the presence of oxygen (O_2) and carbon monoxide (CO). Removal of HSS significantly reduces corrosion and improves amine circuit efficiencies[2].

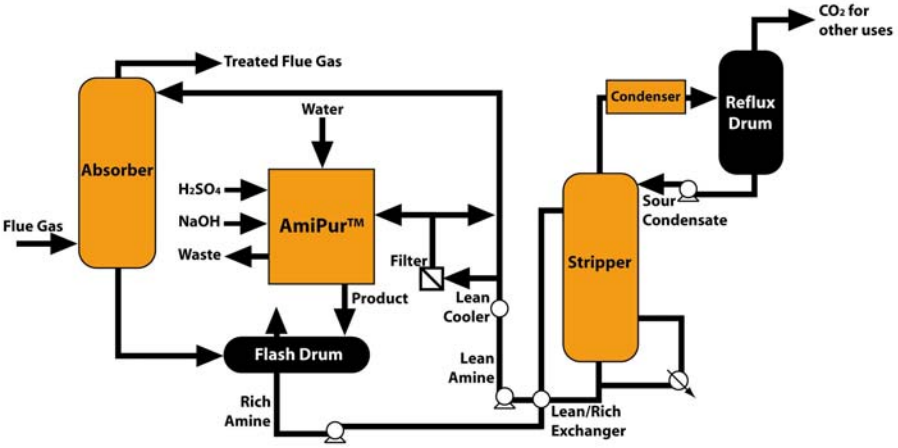
Reboiler piping corrosion caused by HSS build up



CONTINUOUS AMINE PURIFICATION

There are a few known methods for removing HSS from amine such as: purging amines, on-site thermal reclaiming, periodic reclaiming, and continuous reclamation and purification. Continuous purification is the most viable, and is a highly economical, proven, and effective method. By consistently maintaining low HSS levels, continuous purification results in reduced corrosion, and reduced operating costs. An efficient, advanced ion exchange method for continuously removing impurities offers high purity, reclaimed amine. This method also offers other distinct advantages such as scalability.

Different from gas processing, CO_2 sequestration operations have larger capacity demands, requiring that the amine purification system be scalable to meet the large capacity needs. Another important consideration is the amine purification system's ability to reduce solvent degradation and loss. Effective systems that incorporate high capacity with efficient regeneration address this consideration and provide opportunities for lower operating costs.



THE RESULTS

Amine technology within CO_2 sequestration is continuing to prove its effectiveness. Efficiencies and lower operating costs can be achieved with advanced ion exchange technology for the purification of amine. By combining both technologies, fossil fuels will be able to economically provide the energy demanded while also addressing the growing concern of greenhouse gas emissions.

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[1] IEA Greenhouse R&D Programme, Key World Energy Statistics (2002), IAE/OECD, France
[2] Eco-Tec Inc. – Amine Purification (http://www.eco-tec.com)